Hitting Reset: How the Dynamics of Platform Evolution Affect the Value of Firm Experience

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Abstract

In this study, we explore and unpack how the potential value of two broad classifications of experience ? depth and breadth ? shift and change as the industry evolves. We suggest that experience breadth builds organizational flexibility that is especially valuable during times of transition, while experience depth builds powerful resources that are especially important during stable periods. By testing our theory in the console video game industry, where game developers face repeated periods of transition and maturity across multiple console generations, we both reduce concerns about endogeneity and offer novel theory about how and why the value of experience depth ? though reduced by transition ? may generally increase over the industry's evolution, while experience breadth may correspondingly become less important over time.

INTRODUCTION

Organizational experience has direct, important implications for a firm's future success. Through learning-by-doing (Argote & Epple, 1990; Levitt & March, 1988), experience provides knowledge that forms the building blocks of organizational capabilities (Helfat & Lieberman, 2002). Experience has been shown to increase productivity (Darr, Argote & Epple, 1995) and product quality (Levin, 2000; Adams, Day and Dougherty, 1998; Salvato, 2009). Research has sought to articulate different types of experience, recognizing that the effect of heterogeneous types of experience will likely be different (Beckman & Haunschild, 2002; Hoang & Rothaermel, 2010). Primarily, this involves the distinction between experience breadth – experience engaging in many different activities – and experience depth – experience repeating relatively similar activities (Holmqvist, 2004; Huber, 1991; Nerkar & Roberts, 2004).

Despite the potential importance of organizational experience for firm outcomes, the effect of experience is not likely to be consistent over the evolution of the firm and the industry. This is especially true of different types of experience – some experience may be most helpful during the early, more dynamic phases of industry evolution, while others may be more relevant as the industry matures. This aligns with perspectives highlighting the changes in key success factors through the industry's evolution – different capabilities matter more at some times than at others.

In this study, we explore and unpack how the potential value of two broad classifications of experience – depth and breadth – shift and change as the industry evolves. We suggest that experience breadth builds organizational flexibility that is especially valuable during times of transition, while experience depth builds powerful resources that are especially important during stable periods. By testing our theory in the US console video game industry for years 1995-2009, where game developers face repeated periods of transition and maturity across multiple console

generations, we both reduce concerns about endogeneity and offer novel theory about how and why the value of experience depth – though reduced by transition – may generally increase over the industry's evolution, while experience breadth may correspondingly become less important over time.

Our results offer two main findings. First, we find that experience breadth impacts new product performance positively during times of generational transitions, yet otherwise has a negative impact during stable periods. Second, we find that experience depth matters more as the industry itself stabilizes and matures across technological generations, impacting new product performance increasingly positively as years pass in the industry.

This perspective that breadth matters more during turbulent periods is in line with the limited research testing the shifting value of dynamic versus ordinary capabilities (Drnevich & Kriaciunas, 2011; Schilke, 2014). In fact, if we view experience breadth as generating dynamic capabilities, which is in line with King & Tucci (2002), Eggers (2012), and Zollo & Winter (2002), then our paper can be viewed as an additional empirical test of dynamic capabilities theory that both supports the shifting value of dynamic capabilities but also highlights important, cross-generational boundary conditions on the value of such capabilities.

In addition, this study contributes to the literature on platform evolution and the ways in which platforms influence the outcomes of complementary products. Platform companies make significant investments in complementor-management strategies (Boudreau & Hagiu, 2009; Wareham, et al, 2014), and platform-side dynamics have important and understudied implications for the performance of complementors (see Rietveld & Eggers, 2018, for an exception). Our study articulates how the generational shifts extant in many platform markets (e.g., computers, mobile

networks) can have a significant "resetting" effect on the competencies of complementors, offering an opportunity for new firms to enter and compete with existing incumbents.

THEORY AND HYPOTHESES

Studies on the effects of experience on firm performance – whether productivity or product success - have suggested that separating different types of experience to be useful (Moorman and Miner, 1997; Holmqvist, 2004; Nerkar and Roberts, 2004; Mannor, 2009; Salvato, 2009; Eggers, 2012). These could be summarized as breadth and depth of experience – former one capturing experience engaging in same broad activity in many different domains, customizing processes for each different domain, latter one capturing similar experiences over time and building focused competence. In particular, it has been highlighted that breadth of experience is related to first order (dynamic) capabilities as firms learn how to modify their processes and capabilities as expanding the scope of activities, and depth of experience is related to zero order (operational) capabilities as firms undertake better that particular activity (Teece et al. 1997, and King and Tucci, 2002, Winter 2003, Eggers, 2012).

In understanding the shifting value of experience over time within an industry, industry evolution provides the required lens as it is interested in the change in industry characteristics such as competitive dynamics and patterns of innovation as time passes within an industry (Klepper, 1996; Agarwal et al., 2002). Two most prominent ideas in this literature are the concepts of technological discontinuities (Dosi, 1982; Anderson and Tushman, 1990) represented by technology life cycles and learning regime changes (Winter, 1984; Breschi, Malerba, and Orsenigo, 2000), represented by industry life cycles.

In some industries, industry life cycles coincide with their technology life cycles, however in some others, multiple generations of technologies come and go within the same industry life cycle, which require firms to transition from one generation of technologies to the next one (Anderson and Tushman, 1990). These generational shifts play a particularly important role in technological platforms such as video game consoles, smartphones and enterprise IT systems due to multi-sidedness of these markets. Platform owners make significant investments to come up with new generation of technologies, however facing a great uncertainty for competing in this new cycle of the technology, and complementors face both new opportunities with an advanced technology but also a need to adapt in order to develop new skills and capabilities to innovate in these newer generation of technologies – such as independent game developers creating both new programming approaches as well as experimenting with new gameplay elements in each new generation of game consoles (Rietveld and Eggers, 2018; Ozalp, Cennamo, Gawer, 2018).

Experience & Generational Transitions

According to the technological discontinuity view industries are characterized by a cyclical model of technical change. Radical innovations create a discontinuity in technology by dramatically advancing the performance and initiate an era of ferment which is later followed by an era of incremental change. The transition period – i.e., early period of ferment - is a discontinuous shock that requires firms to have new configurations of their knowledge and capabilities (Chen et al., 2012). Transition periods require firms to change their innovation focus from elaborating existing products to pursue the potential of the new technology through major innovations. This is especially true when these technological transitions are accompanied by

changes in customer demand as well as in technology (Adner, 2002; Tripsas, 2009; Chen et al., 2012).

Breadth of experience will increase in value during the transition periods as it builds an ability to be dynamic and reconfigure the processes – through the previous experiences in expanding the activities to new domains, the firm learns how to engage in new activities, adapting to changing conditions (Eggers, 2012). On the other hand, technological transitions fundamentally change activities in the existing market domains, which diminishes the value of experience depth. Although it may not be fully destroyed, at least it will need to go through a process to adapt to new technological cycle to be useful and transitioned to the next generation.

On the other hand, stable periods of the technology cycles emphasize incremental innovation and elaboration of existing knowledge in domains. During these stable periods, experience depth becomes valuable through usual learning-by-doing mechanisms, and acts as an operational capability (Helfat and Raubitschek, 2000; Siggelkow, 2003). However, experience breadth diminishes in value as such experience is valuable changing and turbulent conditions, yet in stable conditions it may even become costly to maintain such a capability due to reduced opportunities to apply it (Zollo and Winter, 2002; Shamsie et al., 2009). Therefore, we predict the following hypotheses regarding generational shifts:

Hypothesis 1: The impact of experience depth on performance decreases during technological transition periods.

Hypothesis 2: The impact of experience breadth on performance increases during technological transition periods.

Experience & Industry Maturity

Most prominent lens in explaining maturation through prototypical phases of lifecycle in an industry is based on evolutionary economics, and this view argues that sources of knowledge leading to the innovative activity determine evolutionary patterns (Gort and Klepper, 1982). More specifically, patterns are formed by the changing learning (technological) regime of the industry, which determines the properties of the knowledge base leading to favorable innovative activity (Breschi, Malerba, and Orsenigo, 2000).

In the growth phase of the industry, an entrepreneurial regime drives innovation (Winter, 1984). In this period, source of knowledge critical in generating innovation lies outside of the established practices in the industry. As such, entrants come to the industry with product innovation in order to use their knowledge advantage (Agarwal et al., 2002). In this earlier phase of an industry, experimentation through broader experiences drive value, whereas deeper experiences have limited use due to the shifting nature of the industrial environment.

As the industry matures, innovation is driven by routinized regime (Breschi, Malerba, and Orsenigo, 2000). In that period, innovation is increasingly determined by incremental process innovations and therefore it favors firms with high stocks of market specific knowledge. These practices will require the firm to compete in incremental innovation, as survival and performance now is dependent on elaborating existing designs or technologies. Such patterns are either reflected in increasing cost-based competition (Klepper, 1996) or increasing R&D expenditures to compete (Klepper, 1997) in order to survive and thrive. Depth of experience will increase in usefulness as an industry matures since refinement and familiarity that comes through development of domain specific knowledge allows the firm to be competitive. On the other hand, broader experiences will diminish in value as the industry-level stabilization occurs, and even if renewal maybe needed for

periods of transition, at the industry level this may reflect smaller changes in a mature industry environment.

Hypothesis 3: The impact of experience depth on performance increases as an industry matures.

Hypothesis 4: The impact of experience breadth on performance decreases as an industry matures.

METHODS AND SETTING

Started from its humble beginnings in early 1970s, US video game industry has become one of the major entertainment industries, reaching to a revenue of 25 billion dollars even by the end of our observation period in 2010 (Entertainment Software Association, 2011). This setting could be summarized in 3 main points. First, video game industry is a mix between creative and knowledge-intensive industries, involving both entertainment and innovation (Mollick, 2012). Second, there are two types of organizations in the software side of video game industry, working together in product development: game developers and publishers.[1] Game developers are responsible with the creative and technical side of game development. These developers are almost always organizations as well as firms, and not sole individuals (Mollick, 2012). Publishers are gatekeepers and provide financing for developers, as well as market and distribute their games. Since publishers take risks by funding developers, they both oversee and work together with them by supporting developers with their advice. Publishers play a great role in determining a game's success by their provision of resources and consequent marketing (Piezunka, 2014). Publishers

[1] Another organization relevant to the industry is console owners – that represents the hardware side of the industry. Console owners themselves can also act as publishers and release games for their consoles, which is controlled for in our analysis.

could also own in-house game developers, which are called "studios".[2] In this study, we will be considering publishers to test our hypotheses, with various controls accounting for developers. Third, success of games is associated with uncertainty, yet fulfilling the needs of consumers is still dependent on the quality of a video game compared to other games (Tschang, 2007) – and consequently success is still considerably dependent on knowledge and capabilities of firms in the industry.

The video game industry is a particularly good setting to test how evolutionary changes affect the value of breadth and depth of experience. First, products and learning from product development experiences play a central role in this industry. Firms need to continually develop new products as an average product makes over %80 of its sales in 12 months (Dezso et al., 2010). Second, there are clearly identifiable technological lifecycles, which presents both challenges of adapting to a new set of technologies and game development approaches as well as opportunities to develop new types of games (Ozalp, Cennamo, and Gawer, 2018). Third, the console game market conforms to the industry evolution patterns due to immense increase in the product development costs, and later shakeout of firms from the industry.

In the video game industry, there are technological discontinuities in the form of new generations of console releases (Balland et al., 2012; de Vaan, 2014). On average every 5 years, a new console generation replaces the old one and it presents both opportunities and challenges for firms. On one hand, industry insiders highlight new opportunities: "each transition to new generations of hardware has always been accompanied by the introduction of these new and original game concepts that become defining games for that particular generation" (de Vaan, 2014; p.1670). However, this also poses challenges for publishers since they need to provide new tools

[2] These studios could be given access to different resources compared independent game developers. We control for this in our analysis.

and resources for developers as well as able to match with changing market requirements of the new technological generation. Perhaps even more important, the big challenge for the publisher is to able to match itself these changing consumer preferences, and how its games will be received both in its existing categories (i.e., genre), and new ones. In line with the discontinuous technical changes, market uncertainty (as well as technical uncertainty) increases following the release of a new generation consoles as it is not clear early on which kind of innovations, or genres will be favored by consumers in that generation. So, although it could be argued that technological changes are "expected" in that industry these changes in the market pose a real dilemma for publishers in the industry.[3] Figure 1 provides the generations of video game consoles with their transition and stability periods, whereas Figure 2 provides the market share changes between genres within the industry following the release of new consoles.[4]

Insert Figures 1 and 2 about here

Last, although being a creative industry, this industry has matured over time due to immensely increasing product development costs, not much different than Klepper's (1997) idea that increasing product R&D expenditures (p.151) as an alternative mechanism for industry lifecycle changes. This change could be best reflected with the mean number of people working in producing games, as this reflects most of the fixed costs involved in this industry. This has caused a shakeout of firms in the industry, conforming to broader industry life cycle patterns as explained by Klepper (1996). In Figure 3, it could be seen that mean number of people worked in

[3] "With target audiences and video game consumption constantly evolving, it is ssential for a publisher to correctly anticipate market trends and to choose the proper format for a game. This strategic choice is crucial, given the sums invested." (Ubisoft, 2009)

[4] These values are calculated by using the sales data and genre information of NPD research, which we will explain in the Methods section.

producing games has tremendously increased over time and gross entry rates (publishers and developers combined) has decreased after 2002.[5] Tschang (2007) documents that these changes have been coupled with "rationalization", which is predominant focus on productivity-oriented processes, similar to adoption of incremental innovation oriented processes explained by Benner and Tushman (2002). This would be also in-line with the (relatively) mature phase as told by the industry evolution literature, which is predominantly characterized by incremental process innovation.

Insert Figure 3 about here

Data

We have relied on multiple sources to build our dataset. The main data source used in this study comes from the *MobyGames* website, which is the oldest and largest online video game archive on the Internet (Mollick, 2012; de Vaan, 2014). MobyGames defines its mission as: "To meticulously catalog all relevant information about electronic games on a game-by-game basis and then offer up that information through flexible queries and data mining." At the time of data collection, Mobygames had information over 72,000 titles, all entered by users of the site on a volunteer basis according to a detailed set of data entry instructions. For the accuracy of information, Mobygames requires all contributed data to pass through peer review to accept it. The data includes title, platform, publisher, developer, credits, release date, release country and information on whether a game uses licensed material (e.g., FIFA Soccer).

Although Mobygames provides publisher (and developer) information for each game, it is not able to fully account for parent subsidiary relationships, merger and acquisitions, and name

[5] Gross entry means total number of firm entries in a given year. Gross entry numbers have been used by industry evolution studies (Agarwal and Gort, 1996; Agarwal et al., 2002) to measure industry life cycle phases.

changes of publishers and developers. Identification of this information is crucial as otherwise main experience variables will be calculated incorrectly, such as not accounting for past history of a publisher (and developer for controls) due to name change. Therefore, publisher and developer information on Mobygames have been complemented by additional information collected manually from GiantBomb, Wikipedia, official firm websites, and Factiva. Those firms that underwent a name change has been associated with only one name to track their experience. Activities of firms that are subsidiaries are all subsumed under parent company. If a firm starts out as an independent company and then gets acquired, it is treated as an independent firm until acquisition and then subsumed under parent company.

We have collected information on over 72,000 games available on the website. From this larger population of releases, only those games released in US until the end of 2011 have been kept (since information is entered by users on the website, lately released and less known titles may not be observed on the site, biasing the sample). Further, we have removed games that are bundles of previously released games and re-releases of same games for different occasions. Also, we have removed games that are produced for handheld consoles and mobile devices since they represent another market than major game industry, especially for the years in analysis. After these, there are 25,399 title-platform releases over the years 1972-2011 released for a personal computer or videogame console. Although we have focused a subset of this dataset for analysis as we will explain below, we have calculated all firm experience variables by using this larger dataset of personal computer (PC) and game console releases to correctly account for game development history of each publisher (and developer).

Following the creation of this dataset, we have chosen to focus one specifically on one segment, console games, as opposed to PC games. There are a number of advantages examining

console games, which make up majority of sales, and up to 85 percent of the market in the period of observation. First, both theoretically and computationally, clear technological lifecycles are both observable and measurable in consoles, that is the new generation of console devices released in every 5 years on average, and associated with changes in the market as well as game development as explained above. Second, releasing a game for a console is significantly more resource intensive than release for a personal computer as it requires to have a licensing deal with the platform owner, and publishers will need much higher sales numbers to reach breakeven point. This makes our dependent variable, game sales, a very fitting measure of performance. Third, industry maturation has mostly affected game releases for consoles as they traditionally have higher entry barriers than game publishing and development for personal computers. Dropping games released for PCs left the data with 11,039 title-platform releases for a video game console.

Finally, this dataset has been matched with another dataset on game revenues between 1995-2010 for dependent variable. NPD research tracks the monthly sales data of every console game sold through U.S. retail channels for most major retailers, and projects sales for the rest. Due to the dependent variable chosen, games that are released before 1995, but are tracked in the NPD as of 1995 as well as games released after 2009 February (due to our dependent variable, as explained below) are dropped as well. Matching these two datasets, and finally removing games that are released in the first year of existence of a publisher (as these firms have no previous experience, see Eggers 2012), resulted in our final dataset consisting of 5,750 title-platform releases between 1995 January-2009 February for 166 publishers.

Moreover, NPD research classifies games into genres, which each represents distinct market segments regarding the development, marketing and consumption of games: these include story, art development, graphic technology, game mechanics, demand segments, marketing,

demographics and so on. Therefore, different genres require different kinds of specific capabilities to succeed in each genre, not different than in the movie industry as highlighted by Shamsie et al. (2009). This is also in line with how capabilities are developed through sequences of experiences through developing different products as in Helfat and Raubitschek (2000). In total, the NPD data set distinguishes between 53 genres that are quite detailed (e.g., Soccer, Tactical Shooter), as well as 13 super-genres (e.g., Sports, Shooter), which represent a higher level aggregation of these detailed genres. However, since we need to calculate experience of publishers as of 1995, which also includes games they developed before 1995, we built a concordance between NPD genre classification and detailed game characteristics provided by the Mobygames data. As mentioned earlier, Mobygames include detailed characteristics on each title which include 8 main genres (action, adventure, RPG, simulation, educational, strategy, racing, sports), 6 perspectives (e.g., 1st person perspective, 3rd person perspective, side scrolling, etc.), and 88 sub-genre characteristics (e.g., shooter, turn-based, etc.) in total resulting in 102 characteristics. In the first step, we re-created NPD genre and supergenre classification using Mobygames characteristics. This step has given us a concordance rate of 62% for genres and over 90% for super-genres.[6] We will be using detailed genre information only to measure depth of experience, and use supergenre information to measure breadth of experience.

[6] Concordance between NPD data and Mobygames data genres is over 90% for most of the smaller, specialized genres (e.g., Basketball, Pinball games, and so on) while it is around 50% for a few very large genres that are both similar to each other, and not distinguishable through Mobygames data. These are General Action games vs. Platform games, and Action Racing games vs. Realistic Racing games.

Variables

The definitions of the variables used to test our hypotheses are summarized in Table 1 and detailed below.

Insert Table 1 about here

Dependent Variable

In line with the product development literature's focus on product level outcomes (Eggers, 2012), revenue is an appropriate performance measure for the game release outcome. As mentioned above, this is especially true for console video games, where concerns of sales are stronger due to more intense resource commitments and costly licensing deals with platform owners undertaken by publishers. Yet, it is more approriate to focus on the revenues of the first year after the release only. This is due to two reasons. First, there are differences between games on the time they spend on the market. Second, this allows us to avoid censoring the games released in the last year of data. As pointed out by the previous research, more than 80% of a video game's sales occur in its first year and pairwise correlation between sales of a game in its first and second years is 99% (Dezsö, Groshjean, and Kretschmer, 2012). In addition, Nerkar and Roberts (2004) also focus on initial sales since it is a good indicator of new product success, based on previous studies (Gatignon et al., 1990). These revenues are also converted to 1995 dollars according to US Consumer Price Index. As a last step, since video games is a hit driven industry, we used the more normally distributed natural logarithm of revenue (lnrevenue) for our analysis. Therefore, dependent variable *Revenue* is the natural logarithm of the revenues generated by a game in the first year after its release.

Independent Variables

In calculating experience variables, we used game releases by the firm in the past five year window. This is due to two reasons. First, prior studies on knowledge and innovation considers five years as an appropriate time window (Fleming, 2001; Katila and Ahuja, 2002). Second, since new generations of consoles are released in five years on average, by this way we also take into account that generational changes discount the previously accumulated experience. Also, previous studies in the same setting also used a five year window due to the fast changing nature of this industry (de Vaan et al., 2014). We also count only unique game releases in calculating experience variables. Many games are released for multiple platforms, therefore having multiple title-platform releases. However, porting is a technical issue that won't give any experience to the firm in developing a certain genre of game. Additionally, we account for this by controlling for experience breadth and depth in platforms (our independent variables are based on experience breadth and depth in genres).

Experience Breadth: The measure of breadth in the publisher's product release experience is based on the Herfindahl index as it reflects the diversity of products the publisher has released in the past. It is computed as: $Breadth_i = \left[1 - \frac{\sum_j {N_{ij}}^2}{\sum_j (N_{ij})^2}\right]$, where N_{ij} is the proportion of games released by publisher *i* in the past five years in genre *j*, that is, the number of games that the firm has in a particular genre divided by the total number of games released by the publisher in the past five years. NPD supergenres are used for this calculation. This variable ranges between 0 and 1, where 1 represents maximum diversity.

Experience Depth: Total volume of experience the publisher has accumulated in the past five years within the genre of the focal new game release, logged to deal with overdispersion. NPD genres are used for this calculation.

(New Technology Generation) Transition: This is the period that starts with the first console release of the new technology generation, and ends at the end of the year all consoles for that generation is released, taking on average three years. This is chosen to allow new games to be released for all consoles in a new generation as it takes several months for all launch titles to appear. This measure is also relevant due to being in line with the industry insiders' comments on the challenges of a new generation consoles, as well as capturing the time where previous generation consoles are still making majority of hardware sales, reflecting early period of the technology life cycle for the new generation.

Year: This variable measures industry maturity, and it is the number of years since 1995 – the first year of our final dataset.

Control Variables

Following Eggers (2012), this study treats the overall product development experience of the publisher (as well as developer) as a control. Again, experience in the past five year window is considered to account for experience decay and it is logged to deal with overdispersion.

A set of controls relate to the title level. Most important title level factor could be the project size itself, which reflects the budget of a game development project. *Project Size* variable has been calculated by using credits information on Mobygames, which is the ratio of the number of people worked on the title compared to other titles in the same year. Since credits information is not available for all games, those games that do not have this information have been given the ratio of 1, yet they have been given a value of one for the *Assumed Size* dummy variable in order to control for the bias introduced by this. Another important control is if a title is produced by a vertically integrated company, that is both publisher and developer is owned by the same parent company. It has been documented that (Tschang, 2007) game development projects differ in terms of

incentive and transaction cost issues if a developer is owned by the publisher or not. This is controlled with *In-house* variable. Games could be also based on a movie or franchise license (such as Star Wars, NFL or FIFA). *Licensed Title* variable controls for this. A game could be also a sequel, which will be produced upon the success of previous games in the series. This is controlled with the *Sequel* variable. We also control for blockbuster titles by controlling for releases done in months of *October* and *November* (high-quality titles self-select to release in these key months of the year).

At the publisher and developer level, there are three controls. Most important is the publisher-level fixed effects for all estimations, and developer-level fixed effects for the robustness checks. Second, firm size is also required to be controlled. As pointed out by previous research (de Vaan, 2014), it is virtually not possible to collect information on the revenue or number of employees for many small development firms. It has been also pointed out that number of games released in a year is 0.95 correlated with firm revenue for a subset (p. 1675). Therefore *Logged Number of Games* released in a year controls for firm size. Last controls used at the firm level are *Publisher Age* and *Developer Age*. Also, video games are produced by console owners as well, who would arguably have different incentives as well as information on leveraging new generation consoles. *Console owner* variable controls for this. Finally, we also control for the *breadth* and *depth of experience* a publisher has in platforms. These variables control for any technical confounding effects regarding our hypotheses.

As a last set of control variables genre specific and platform specific effects on game revenues have been controlled for. At the genre level, some of genres could be more popular than others in overall (action vs strategy), and therefore we add genre fixed effects for all NPD genres. Again, some platforms may be more popular than others, influencing the revenues of a title in a

platform (though note that popularity may not necessarily lead to higher revenues, see Cennamo and Santalo, 2013). This is controlled with platform fixed effects.

At the industry level, we control for the total logged sales of all games in the release year of each game. This variable, however, drops in regressions including interactions with industry year as they are very closely correlated.

Analysis Procedures and Descriptive Statistics

The models used are OLS with robust standard errors clustered at the publisher level and with fixed publisher, platform, and genre effects, with one observation for each new title on a platform released. Firm fixed effects are important for two reasons. First, they control for unobserved heterogeneity between organizations. Second, they allow for evaluations of how within-firm changes in experience variables are affected by evolutionary changes in determining outcomes (Eggers, 2012). All independent and control variables are lagged for one year in analysis.

Summary statistics and correlations are presented in Table 2. It can be seen that none of our independent variables are alarmingly correlated. Especially considering our main experience variables, breadth and depth, we see that they are correlated at .24. This lends further support to the idea that breadth and depth of experience are different dimensions of experience. Several control variables, however, show high correlation with some other variables – such as the expected correlated between industry year and total size of the industry. In additional regressions, dropping these highly correlated variables resulted in no qualitative change in results.

Insert Table 2 about here

Results

Table 3 shows results regarding the relationship between generational transitions and the impact of experience depth and breadth on newly released games' sales performance. Full Model with interactions shows that experience depth has significantly lower value during times of generational transitions – as can be seen by comparing the coefficients between the main variable and its interaction, experience depth has no effect during transitions, and instead has a positive effect during stable periods. This supports our Hypothesis 1. Same Full Model shows that breadth has significantly higher value during times of generational transition, supporting Hypothesis 2. Our post-hoc analysis also shows the source of improved performance through experience breadth in times of transition – we find that it comes from releases in genres that are new to the publisher, corroborating previous findings in the literature on how experience breadth works as a dynamic capability (Eggers, 2012).

Table 4 shows results regarding the relationship between industry maturity (industry year) and the impact of experience depth and breadth on newly released games' sales performance. Full Model 3 shows that experience depth gets more valuable as the industry matures, whereas breadth shows minimal change across years in the industry. These results support Hypothesis 3, but do not support Hypothesis 4.[7]

Insert Tables 3 and 4 about here
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[7] Due to space and time constraints, in unreported regressions, we controlled for the robustness of our results. We found that our results are robust to the use of different experience breadth measure (entropy) and shows some changes based on the definition of transition variable (using individual new consoles, rather than defining transition generationally). In particular, we find that the relationship between experience depth and new consoles are getting even stronger, whereas the relationship between experience breadth and new consoles get weaker. This could well be due to depth relating to specific approaches based on particular genres, and breadth, as a dynamic capability, refers more to adapting the whole generational changes occurring across genres.

These results could also be corroborated with some qualitative evidence on video game publishers. First, considering the technology life cycles, Ubisoft's CEO Yves Guillemot says that: "It's a lot less risky for us to create new IPs and new products when we're in the beginning of a new generation... Our customers are very open to new things. Our customers are reopening their minds -- and they are really going after what's best. ... At the end of a console generation, they want new stuff, but they don't buy new stuff as much".[8] This quite reflects why publishers benefit a lot from their deeper experiences well into the technology life cycle, but not at all early on. Second, considering the industry life cycle, two prominent examples show how publishers focused on benefitting from their deeper experiences, but eventually they are harmed (or failed) when broader experience become important again later on. EA (Electronic Arts), which is the biggest publisher in the period of observation of my study, has entered a period of loss around 2006, which is reflected as the de-maturation period. EA, for years, has been focusing on its genres where it has very deep experience, and has been surprised when it started to make losses: "EA became the games industry's 800-pound gorilla...monopolise entire genres for years on end. It created franchises which were annually refreshed, milking the cash cow anew with each iteration... After years when it seemed content to sit back and churn out annual updates and movie licences, EA has been brought up short by a stagnation of its income - at a time when its development expenses have skyrocketed..." and EA realized that market was changing, and it again become a broader company with some more focus on different games, genres and so on: "Riccitiello's sure hand on the tiller is guiding the firm back into the kind of waters that Trip Hawkins originally envisioned

[8] http://www.gamasutra.com/view/news/174498/Ubisofts_Guillemot_New_consoles_are_overdue.php, accessed 29 October 2015.

back in the 1980s, and words like risk, innovation and originality are no longer dirty"[9] And indeed, EA has been very successful in the recent years. A last example is from THQ, which was one of the biggest publishers just a few years before its bankruptcy. THQ was a publisher that relied on many licensed kids' titles ("family games and children's games genres in the NPD data), where started to have massive losses towards the end of 2000s. It required to change its product development strategy, and broaden its genres, especially focusing on bigger titles, which was the mandate of the industry, but its previous lack of such experience did not allow it to do so: "The company that had generated millions from games based on Finding Nemo and WWE, had struggled to transition into a world where kids games and licensed titles were no-longer safe bets... In an industry that's enduring a painful transition away from the triple-A, boxed game model, mid-tier publishers are the ones that will ultimately get squeezed out. THQ is just the first big victim... It is also quite important with projects of this size that THQ was dealing with, that these projects are being thought through from start to finish early on, and you don't run into problems of discontinuing development or changing a game concept in the middle of the development."[10]

DISCUSSION AND CONCLUSION

In this study we explored how the value of experience depth and breadth shifts across technological transition and stable periods as well between early and more mature stages of an industry. In particular, our context also allowed us to explore how changes in the core platform technology across generations affects the fortunes of complementors working on these platforms, moving beyond the usual standard network effects-based platform research based on the platform owner's perspective (McIntrye and Subramaniam, 2017). Our findings also go beyond the previous research on the shifting value of capabilities across multiple generations of technologies and over

[9] http://www.eurogamer.net/articles/electronic-arts-back-in-the-game-article, accessed 29 October 2015.
[10] http://www.engadget.com/2008/11/05/thq-reveals-significant-business-realignment/, accessed 29 October 2015.

15 years of evolution within an industry, which has been previously studied with cross-sectional surveys (Drnevich & Kriaciunas, 2011), or short-term longitudinal studies (Schilke, 2014). We find that experience breadth indeed works as a first-order dynamic capability during technological transition periods, yet, it has its own limitations as experience depth becomes much more valuable as the industry matures. This study represents an early step to understand better how the value of experience shifts across technological and industry life cycles in a platform context, which represent an increasingly growing area of activity for many firms. As more and more firms are transitioning to such platforms, we need more research to understand how these complementors' fortunes, which are key to the success of platforms, shift given their experience profiles and the shifts on the technologies and industry they belong to. The following discussion highlights our key findings that have critical implications for future studies of experience and outcome link, platform evolution, and dynamic capabilities literatures.

First, our central finding that both depth and breadth of experience have contingent effects based on generational lifecycles in a platform market context offer implications for studies on multi-sided platforms, especially for recent studies offering a "complementor" perspective to understand their factors of success and failure (Rietveld and Eggers, 2018; Cennamo, Ozalp, and Kretschmer, 2018). In particular, we add to the evidence on how dynamics of the evolution of platforms create both turbulence and opportunity for complementors – with relative success of failure based on the complementors' experience profiles. It also provides a direction for further ressearch on how platform "context" affects complement dynamics presents interesting opportunities for evolutionary idiosyncrasies.

Second, our finding that the benefits of depth and breadth of experience, reflecting experience-based ordinary and dynamic capabilities respectively, were contingent on the technology and

industry lifecycles hold important implications for the shifting values of these capabilities as well as the limits of dynamic capabilities. Previous studies on this subject were mostly based on surveys, either cross-sectional (Drnevich & Kriaciunas, 2011) or short-term longitudinal (Schilke, 2014), which raises serious concerns about survey biases, as well as tautology of equating "capability" with the success. Our analysis is able to separate experience from success, looking at under which conditions experience-based ordinary and dynamic capabilities are more or less valuable in changing conditions within an industry. Our findings show that although broader experience base helps in face of change, and indeed may represent such dynamic capabilities, it is not without its own costs. Rather, as an industry passes to mature stage from the growth stage, such capabilities may become more costly to maintain. This supports the idea of Winter (2003) that if there are sparse opportunities for competitively significant changes, then the costs of development of integrative knowledge may far exceed benefits acquired from core knowledge. Rather, the more "dynamic" capability may reside in making timely choices as per product development. In another creative industry, Shamsie et al. (2009) show that it is more important for a movie studio to make timely use of its different types of knowledge and capabilities to create a series of temporary competitive advantages under changing industry conditions. Further studies should delve deeper for understanding such relationships in a longitudinal way to better to enlighten us on higher level capability building.

Finally, our study offers some novel implications for the dynamics of capability development. Our finding that, depth of experience increasing in value over time, with some temporary setbacks during times of transition, may challenge the received wisdom on inertia and technological change in industries. In particular, our findings shows that the increase in the focus of firms becomes more valuable as industry progresses – although transitions are potential pitfalls for such focused firms,

they may also choose to remain in the older technology until the transition period completes. We also found that experience breadth, contrary to our expectations, did not lose its value as the industry progressed. It may well be that there is enough constant change in this industry, such that the above-mentioned maintenance of dynamic capabilities, in fact, is not costly relative to its benefits. Further studies should also look into these dynamics in other contexts.

Naturally, this study also has limitations. First, a potential issue is unobserved heterogeneity in the dataset, which is the concern that the decision of where and when to develop a new game is not exogenous (Eggers, 2012). Publishers may in fact be aware of their advantages, and may build on their deeper experienced genres to benefit in the mature period of the industry. Given prior experiences, this study assesses when a firm may have advantage in developing a product in a given time and genre. Another concern could be the industry of this study, which is a creative industry and therefore naturally require novelty and familiarity together in order to achieve success (Lampel, Lant, and Shamsie, 2000). However, also note that the relative of importance of novelty and familiarity is also changing through the industry (Tschang, 2007), which we capture through technology and industry lifecycle changes.

In terms of generalizability, mechanisms argued in this article are based on literatures of experience and industry evolution, which studies wide-ranging industries, and therefore mechanisms guiding these interactions of experience and industry evolution should be observable in many industries. Benefits from breadth of experience rises from integrative knowledge and experience heterogeneity, which is discussed or observed in many settings earlier (Helfat and Raubitschek, 2002; Haunschild and Sullivan, 2002; King and Tucci, 2002; Schilling et al., 2003; Chen et al., 2012), while benefits from depth of experience rises from the core knowledge, that is explored in multiple industries in Helfat and Lieberman (2002). Perhaps, it could be true that some

industries do not observe multiple technology life cycles, or traditional industry life cycle, but most of the industries at least observe one of these major evolutionary changes, which gives additional confidence in the generalizability of results.

In conclusion, prior research has implicitly assumed that industry context remains static in looking at the experience-outcome link. In comparison, our theory and results suggest that competitive shifts, due to evolutionary forces in an industry has a profound effect whether depth and breadth of experience will improve success or not (or may even reduce success). Our findings offer important implications for the literatures on complementor strategies in platforms as well as experience-based capability development and shifting values of ordinary and dynamic capabilities.

TABLE 1

Variable Descriptions

Variables	Description
Dependent variable	
Revenue	Natural logarithm of the revenues generated by a game in the first year after its release (1995 price index converted).
Independent variables	
Experience Breadth	Diversity of product development experience. Calculated as the Herfindahl index, reflecting the diversity of products the firm has developed in the past.
Experience Depth	Total volume of experience the firm has accumulated in the within the genre of the focal new game release.
Transition	Dummy = one for games released in the years of a technological generation until the end of the year all consoles for that generation is released.
Years	Number of years since 1995, starting year of our final dataset.
Control variables	
Console Owner	Dummy = one if game is published by a firm that is also the owner of the focal game platform. Active platform owners never publish a game on a rival platform.
Project Size	Relative number of people worked on the title compared to the average of all games released in the same year. Game releases with missing information have been given a value of one.
Assumed Size	Dummy = one if game has no project size information available and given one as project size value.
Licensed Title	Dummy = one if a game is based on a license.
Sequel	Dummy = one if a game is a sequel in a series.
In-house	Dummy = one if publisher and developer belong to the same parent company.
Overall Experience Volume	Total product development experience in the past five year window. Calculated both for publisher and developer.
Firm Size	Logged number of games released in a year controls for firm size. Calculated both for publisher and developer.
Firm Age	Number of years since the first game release of the firm. Calculated both for publisher and developer of the focal game.
Industry Size	Logged total sales in the industry in the release year of the game
Oct. & Nov. Release	Dummy = one if game is released either on October or November. Blockbuster titles are released during these two months for Christmas.
Platform Breadth & Depth	Controls for the breadth and depth of platform experience of publisher.
Firm Age	Number of years since the first game release of the firm. Calculated both for publisher and developer of the focal game.

TABLE 2

Descriptive Statistics and Correlation Matrix

		Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	Revenue	14.65	1.51	9.72	19.96	1																					
2	Console Owner	0.12	0.33	0	1	0.17	1																				
3	Project Size	1.1	0.69	0.01	10.19	0.3	0.03	1																			
4	Assumed Project Size	0.2	0.4	0	1	-0.1	-0.04	-0.07	1																		
5	Licensed Title	0.44	0.5	0	1	0.12	-0.13	0.07	0.08	1																	
6	Sequel	0.42	0.49	0	1	0.27	0.03	0.1	0.04	-0.02	1																
7	In-house	0.46	0.5	0	1	0.26	-0.01	0.22	0.06	0.05	0.23	1															
8	Publisher Age	15.43	6.63	1	29	0.33	0.13	0.19	0	0.08	0.21	0.27	1														
9	Developer Age	10.85	7.7	0	29	0.26	0.03	0.18	0.06	0.01	0.24	0.66	0.5	1													
10	Publisher Experience	92.62	70.95	0	319	0.26	0.33	0.22	-0.02	0.18	0.17	0.22	0.42	0.19	1												
11	Developer Experience	30.98	39.99	0	164	0.27	0.03	0.21	0.08	0.14	0.25	0.66	0.39	0.61	0.56	1											
12	Publisher Size (ln)	3.27	0.89	0.69	4.65	0.27	0.09	0.22	-0.04	0.23	0.15	0.24	0.39	0.16	0.75	0.48	1										
13	Developer Size (ln)	2.16	1.1	0.69	4.51	0.26	-0.07	0.23	0.04	0.19	0.23	0.74	0.33	0.62	0.42	0.84	0.5	1									
15	Industry Size (ln)	22.09	0.44	21.24	22.8	0.16	-0.18	0.04	0.05	0.09	0.1	0.08	0.47	0.31	0.02	0.14	0.06	0.15	0.94	1							
16	October Release	0.13	0.34	0	1	0.1	0	0.04	-0.03	0.01	0.04	0.03	0.04	0.04	0.01	0.02	0.04	0.03	0.07	0.07	1						
17	November Release	0.28	0.45	0	1	-0.06	0.03	0.05	0.02	0.02	-0.06	-0.05	-0.16	-0.11	0	-0.06	0	-0.05	-0.25	-0.25	-0.25	1					
18	Depth (Platform)	2.23	1.43	0	5.33	0.19	0.29	0.11	0.03	0.11	0.14	0.13	0.38	0.17	0.53	0.3	0.45	0.23	0.13	0.09	0	-0.08	1				
19	Breadth (Platform)	0.67	0.18	0	1	0.12	-0.21	0.13	-0.02	0.12	0.06	0.19	0.28	0.11	0.3	0.21	0.46	0.28	-0.02	-0.05	0.02	-0.02	0.28	1			
20	Depth (Genre)	1.48	0.99	0	4.26	0.22	0.12	0.17	-0.07	0.11	0.22	0.22	0.33	0.21	0.52	0.33	0.45	0.3	0.11	0.1	0	-0.02	0.33	0.26	1		
21	Breadth (Genre)	0.79	0.13	-0.06	1	0.18	0.16	0.08	-0.08	0.08	0.04	0.05	0.35	0.11	0.34	0.09	0.38	0.09	0.05	0.07	0.03	-0.05	0.3	0.44	0.24	1	
22	Year	7.19	3.9	0	14	0.16	-0.17	0.05	0.07	0.09	0.11	0.1	0.51	0.34	0.03	0.16	0.07	0.17	1	0.94	0.07	-0.25	0.13	-0.02	0.11	0.05	1
23	Transition	0.25	0.43	0	1	-0.01	0.08	0.04	0.01	-0.08	-0.03	0.08	-0.05	0.03	0	0.04	0.02	0.06	-0.12	-0.14	0	0.1	-0.43	-0.01	-0.02	-0.03	-0.12

TABLE 3

Regressions for the New Product Performance with Moderating Effect of Technological Transition

VARIABLES	Controls	Depth & Breadth	Interactions
Transition	-0.001	-0.003	-0.582*
	(0.054)	(0.054)	(0.283)
Depth (#games in genre t-5 to t-1)		0.053^	0.076*
		(0.029)	(0.031)
Transition X Depth			-0.099*
			(0.047)
Breadth (Herfindahl genre t-5 to t-1)		-0.149	-0.497
		(0.367)	(0.374)
Transition X Breadth			0.916**
			(0.349)
Constant	14.602***	14.638***	14.781***
	(2.229)	(2.252)	(2.328)
Observations	5,750	5,750	5,750
R-squared	0.311	0.312	0.314
Observations (publishers)	166	166	166
Controls (see Table 1)	YES	YES	YES
Publisher FE	YES	YES	YES
Platform FE	YES	YES	YES
Genre FE	YES	YES	YES

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, ^ p<0.10

TABLE 4

Regressions for the New Product Performance with Moderating Effect of Years Since 1995

VARIABLES	Controls	Depth & Breadth	Interactions
Depth (#games in genre t-5 to t-1)		0.053^	-0.087
		(0.029)	(0.071)
Year X Depth			0.018*
			(0.007)
Breadth (Herfindahl genre t-5 to t-1)		-0.148	-0.050
		(0.369)	(0.518)
Year X Breath			0.010
			(0.074)
Constant	14.594***	14.616***	14.259***
	(2.202)	(2.222)	(2.418)
Observations	5,750	5,750	5,750
R-squared	0.311	0.312	0.314
Observations (publishers)	166	166	166
Controls (see Table 1)	YES	YES	YES
Publisher FE	YES	YES	YES
Platform FE	YES	YES	YES
Genre FE	YES	YES	YES

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, ^ p<0.10

FIGURE 1

Generational Cycles with Periods of Transition and Stability in US Video Game Console Industry

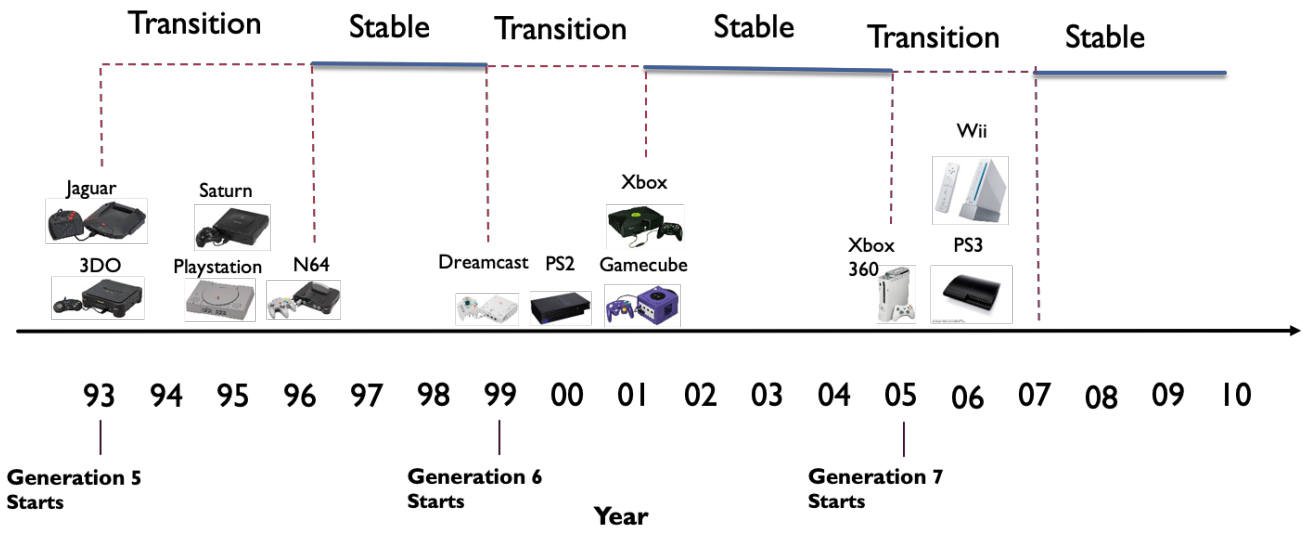


FIGURE 2

Console releases and year-by-year absolute total of market share changes between industry genres

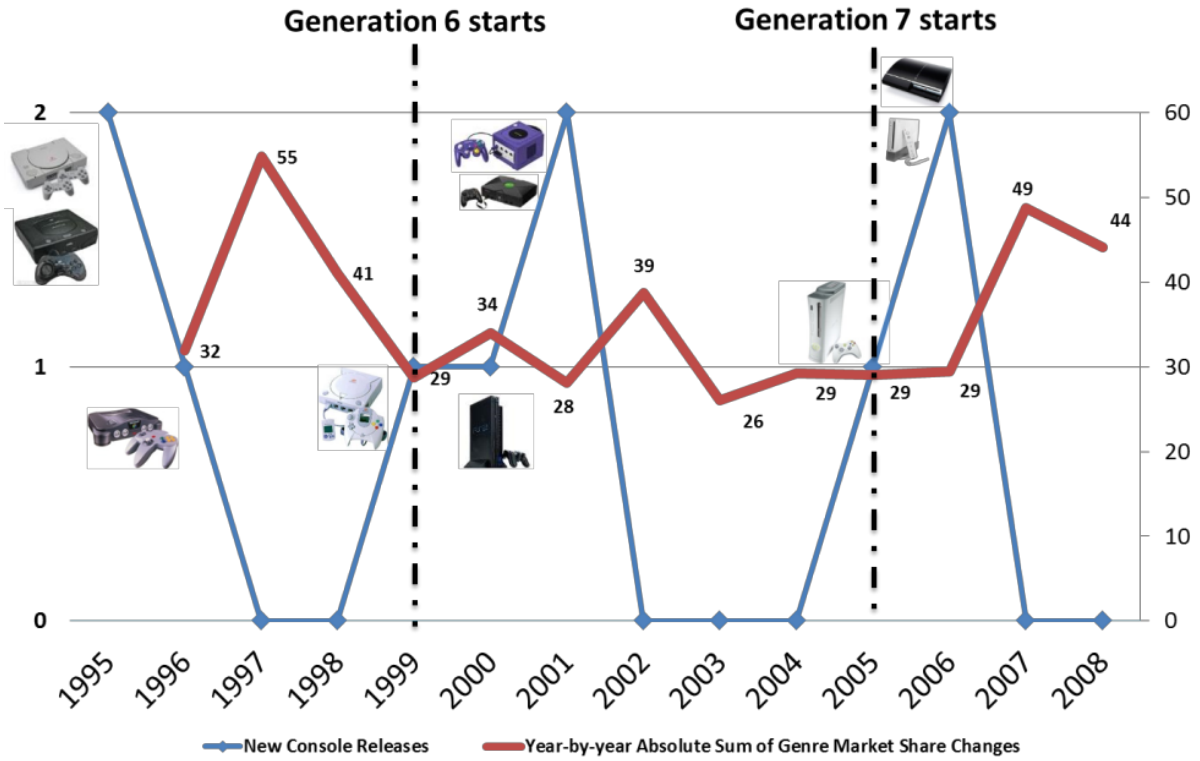
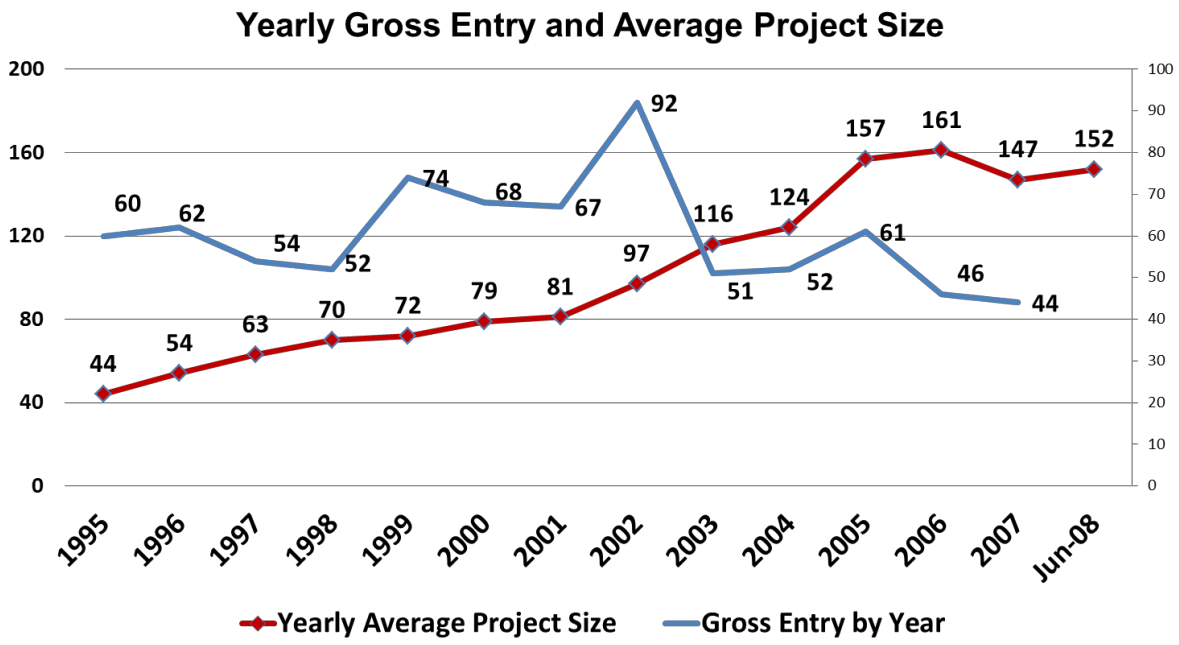


FIGURE 3

Yearly industry average project size and firm gross entry



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